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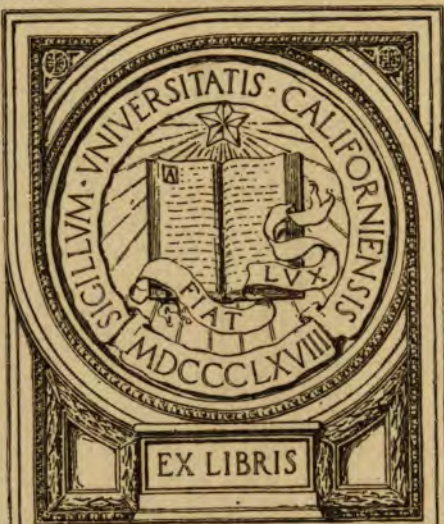
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INSTRUCTIONS FOR MOUNTING
USING, AND CARING FOR
8-INCH BARBETTE CARRIAGES

MODEL OF 1892

FOR

8-INCH RIFLE

MODEL OF 1888

(FOUR PLATES)

REVISED MAY 31, 1904
REVISED DECEMBER 13, 1907



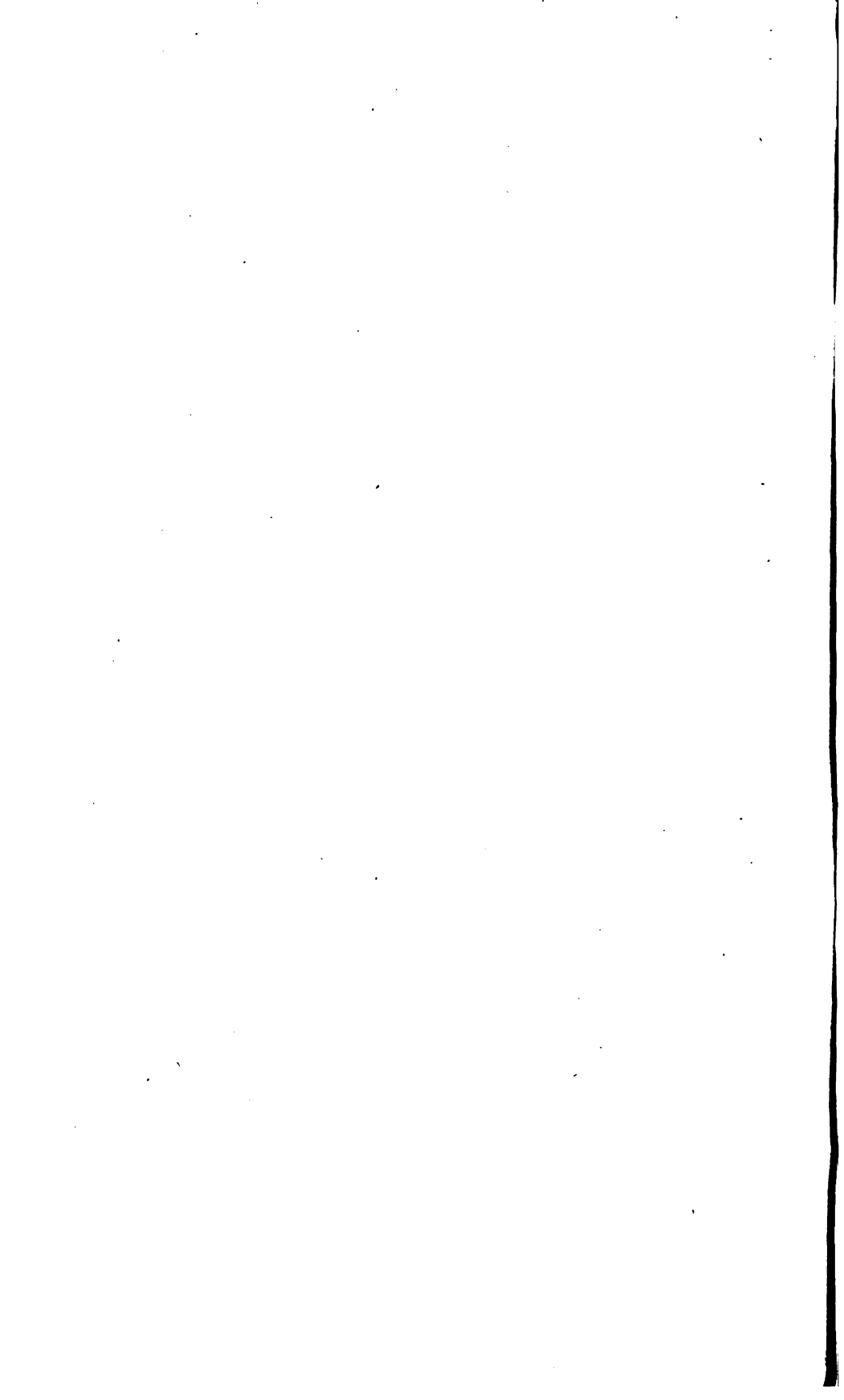
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INSTRUCTIONS FOR MOUNTING, USING, AND CARING FOR 8-INCH BARBETTE CARRIAGES, MODEL OF 1892.

(4 plates.)

[The points in italics are of importance or concern the safety of the carriage and should be specially noted.]

GENERAL DESCRIPTION.

The carriage.—This carriage is designed to mount 8-inch guns of the model of 1888, and is of the center pintle form, permitting the gun to be traversed through 320 degrees, and elevated from minus 7 degrees to plus 18 degrees.

The gun can be loaded at 5 degrees or even higher angles of elevation.

Action of carriage.—Upon firing the piece, the gun and top carriage move to the rear about 40 inches along the 4-degree inclination of the chassis rails. The energy of recoil is absorbed partly by the raising of the gun and top carriage vertically, due to the inclination of the chassis rails, and by friction, but principally by the resistance of the recoil cylinders. When the gun comes to rest it is immediately returned to the firing position against the stops by the action of gravity, since the slope of the chassis rails is greater than the angle of friction. The energy of counter recoil is absorbed by means of the counter recoil buffers.

Principal parts.—It consists of the following principal parts, namely: Base ring, azimuth circle and pointer, combined racer and chasis, clips, traversing system, top carriage and recoil rollers, recoil and counter recoil system, elevating and retracting system, elevation indicator, loading platform, shot hoist, sight standard, and accessories, including ammunition truck, shot trays, and implements.

Base ring.—The base ring is of cast iron, secured to the foundation by sixteen 2-inch bolts through the flange. Eight screws for leveling the base ring are provided between the foundation bolts. They are screwed in the flange and bear upon steel plates embedded in the foundation beneath the flange of the base ring.

The upper surface of the base ring forms the lower traversing roller path. Rising from the center of the base ring is an annular flange

which forms the pintle and is provided with an oil groove on its outer surface.

A flange on the exterior vertical wall of the base ring supports the traversing chain, the two ends of which are secured by adjusting bolts and nuts to lugs cast on the rear part of it.

The outer edge of the lower roller path constitutes a flange under which the clips engage.

Azimuth circle and pointer.—A brass azimuth circle is attached by countersunk screws to the outer edge of the lower roller path and is graduated to degrees, but the numbers are to be added after the carriage is in its emplacement.

The right rear clip is recessed to expose the azimuth circle, and in the recess an azimuth pointer and subscale is placed, remaining in smooth contact with the azimuth circle when the carriage is traversed.

The pointer is graduated to 0.05 of a degree, figured hundredths of a degree and slotted to permit of lateral adjustment, after which it is fixed in position by two dowel pins.

Combined racer and chassis.—The racer and chassis are of cast iron in one piece, with transoms and inner and outer strengthening ribs. The lower part, cylindrical in shape, forms the racer. On its under surface are the upper traversing roller path and the female part of the pintle, which extends down over the part on the base ring.

The top of chassis is formed with U-shaped recesses for the recoil rollers and on the outer edge with a flange extending into the top carriage clip. They slope downward to the front at an angle of 4 degrees, are united by two transoms, and have upright lugs at the front end, to which the piston rods are secured. These lugs and the front ends of chassis are also formed to support a shield. A projecting lug on the front of each chassis forms a bearing for the traversing crank shaft.

Clips, etc.—The racer is secured to the base ring by four clips bolted to its outer rim, the hooks of which engage the under side of the roller path flange on the base ring.

Between these clips is a dust guard in four sections, extending around and inclosing the traversing rollers and azimuth circle, each section being secured by screws to the racer.

A hanger is attached to each side of the racer, on which are secured two steps for mounting it.

Traversing system.—The supporting part consists of 20 conical forged-steel live rollers, which revolve upon the lower roller path and upon which the racer is supported and is traversed. These rollers are held in place by two rings framed up concentric by 10 separators with screw bolts. The system is kept concentric with the pintle by flanges on the inner end of the rollers in centrifugal contact with the inner edges of the roller path.

The operating parts consist of the traversing chain, secured to two lugs on the rear part of the base ring and laying around the latter, beneath two guide sheaves journaled in swiveled supports projecting downward from brackets bolted to the front part of the racer and up over a sprocket wheel which receives motion from a worm upon a crank shaft journaled across the front part of the chassis.

The top carriage and recoil rollers.—The eight forged steel recoil rollers in the U-shaped recesses of the chassis rail are mounted on pins and extend just sufficiently above the surface to prevent rubbing contact. The rollers are bronze bushed and oiled through the pins. The pins bear in the outer side and are screwed into the inner side of the U-shaped recesses.

The top carriage is of steel, cast in one piece. It consists of two trunnion bed side frames, in which are cast the two recoil cylinders, united by a transom passing under the gun. It rests on each side upon the eight recoil rollers, and has extending underneath the whole length of the cylinder a clip which engages underneath the outer flange of the chassis rail.

Recoil and counter recoil systems.—The cylinders are 8.5 inches in interior diameter fitted with piston rods 3.25 inches in diameter, having pistons screwed on and with a clearance of 0.01 of an inch all round. The rods are secured by nuts to the upright lugs on chassis.

The rear end of each cylinder is closed by a screwed cylinder head, which has in its front face a cylindrical cavity 5 inches deep with rounded bottom, in which the male part of the counter recoil buffer enters with a diametral clearance of 0.01 of an inch. When the gun returns to the firing position the liquid caught in the cavity can only escape through the small clearance, thus acting as a buffer to check the velocity at the end of the return into battery.

At the front end of the recoil cylinder there are the usual stuffing boxes with glands and followers.

To secure equal resistance and equal fluid pressure in the two cylinders, equalizing pipes connect the front or pressure end.

In this pipe is an emptying coupling, but on account of the location at which the pipe enters the cylinder the system can only be partly emptied by the coupling.

Each cylinder is provided with a filling hole at its rear end and with a drain hole at its front end.

Bronze plugs are provided to be screwed into the cylinder in the place of the equalizing pipe, thus continuing the piece in action should the pipes be destroyed.

The cap squares are dovetailed, and are each secured by two tap bolts. Grease cups are provided to insure proper lubrication of the trunnion beds, and are connected by pipes with oil grooves in the bushings of the trunnion bed.

After recoiling, the gun returns to the firing position at once by the action of gravity, the slope of the chassis rails being sufficient to permit the top carriage to move forward on the rollers.

During the recoil the pistons remain stationary and the top carriage with its cylinders is drawn over them. Each piston is slotted through its opposite sides and two throttling bars lie in the slots and extend the whole length of each cylinder. Their sectional area is such that the orifices for the flow of the liquid vary with the position of the piston during recoil, so as to attain the desired resistance in the cylinder.

In any hydraulic brake the resistance is greater as the velocity of the piston in the cylinder is greater and as the openings for the passage of the oil are less. The velocity of retarded recoil of the top carriage being variable and a constant resistance being desired, the orifices are usually varied in such a manner that the relation between the velocity and the area of the orifices is at all points such as to give a nearly constant resistance.

Uniform resistance to the motion of the top carriage is obtained, its motion retarded and finally stopped and the energy of recoil taken up principally by the resistance which the oil in the cylinders offers while being forced from one side of the piston to the other through the following openings:

(a) The clearance between the walls of the cylinder and the piston, necessary for working movement. This opening is a constant area.

(b) The orifices between the throttling bars and their slots in the piston. These openings vary with the profile of the throttling bars, since the slots which are partially closed by these bars have a constant area.

The two throttling bars in each cylinder are constructed of constant width, with only a sufficient lateral clearance in the slots for working movement, and of varying depth, the profile being so designed that the area of the orifices (the portions of the slots not filled with the bars) for the escape of the oil past the piston increases from the beginning of motion up to the point where the velocity of retarded recoil of the top carriage is greatest; beyond this point the velocity of retarded recoil of the top carriage is continually decreasing and the area of the orifices decreases also until it becomes zero at the end of the recoil. The orifices have at each point of the recoil such a relation to the velocity of retarded recoil of the top carriage at that point as to give nearly a constant resistance to the motion of the top carriage. This results in nearly constant fluid pressure in the cylinder.

The areas of the orifices have to be calculated for a particular set of conditions of loading, and any variations in these conditions will change the length of recoil of the top carriage.

For all charges the cylinder should, before firing, be completely filled to the level of the filling hole.

A neutral oil, of specific gravity about 0.85 (such as the hydroline at present issued), is used, and about 19 gallons are required to fill the cylinder and pipes of one carriage.

Elevating system.—Pointing in elevation is given by an arc rack bolted to a band shrunk on the gun. A pinion upon a short cross shaft in bronze-bushed bearings in the top carriage over the rear end of the right recoil cylinder engages the rack. At the outer end of this shaft there is keyed a friction clutch disk, fitted in a ground seat in the outer face of a worm gear, and brought to a bearing by a nut on the end of the shaft. Excessive stress on the elevating system during firing is relieved by the slipping of this clutch. This worm gear engages in a worm keyed upon a vertical shaft which has its bearings in two lugs in the outside of the top carriage. On the lower end of this worm shaft there is keyed a miter gear which meshes with a second miter gear upon the main elevating shaft. This second gear slides upon the squared section of the side shaft, being carried back and forth in the recoil of the top carriage by an arm cast upon the latter, through which the hub of the gear extends and is secured by a nut. This shaft is supported, parallel to the top surface of the right chassis, by two wrought-iron brackets bolted to the outer face of the latter, and has another miter gear keyed to its front end which engages in a miter gear mounted on a transverse through shaft having its bearings in bronze sleeves bolted to the chassis rails near their forward ends. On each end of this shaft there is a bronze hand wheel.

Elevation indicator.—The indicator consists of a graduated arc attached to the left trunnion bed on top carriage, against which a geared and counter-weighted arm travels, actuated by a segment of a gear attached to the end of the gun trunnion. The arc is graduated to half degrees and the arm scale subdivided to read to the least graduation of two minutes and figured every ten minutes to be read in both directions.

The retracting system.—The retracting gear consists of a crank shaft passing through the chassis and connected by a train of spur gears with another through shaft having drums upon its ends on the outside of the chassis. These through shafts and the short shaft carrying the intermediate gear wheels have also bronze-bushed bearings in a retraction bracket bolted to the top of the racer. Wire retraction ropes are secured to the drums and lead around guide pulleys at the rear end of the chassis to hooks bolted to the sides of the top carriage. The shot-hoist cranks are used for this work, being secured in place by latch springs, which enable them to be quickly changed from one shaft to the other.

Loading platform.—The loading platform is made up of steel plates roughened with a picking tool and supported upon four cantilever beams bolted to the rear side of the chassis and racer. It is inclosed

by a railing of iron pipe and provided with four steps on each side. A sighting platform is bolted to and projects from the right side of the loading platform, being supported by braces to the cantilever beam.

Shot hoist.—A crane resting in steps on the left side of the chassis is provided for raising the projectile from the ammunition truck to the breech of the gun. The fall of the hoisting tackle leads from the crane sheaves to a drum mounted on a shaft passing through the chassis rails and having its end squared to receive the removable cranks. The shaft is prevented from turning backward by the usual ratchet and pawl.

Chassis sight standard.—A bracket or standard is bolted to the rear end of the right chassis in a proper position to receive the telescopic sight bracket at such a height as is convenient for the gunner while standing on the sighting platform on the right side of the loading platform. The sight in this position can give direction only.

Ammunition trucks, shot trays, etc.—The ammunition is served to the gun on an ammunition truck, three being furnished for each carriage. The powder is passed up on the loading platform, the projectile being raised and swung around to the breech of the piece by the shot hoist. The frame of the truck is built up mainly of angle irons riveted. The cartridge shelves are of steel plate. The truck is supported upon four wheels, being propelled on the two large ones only. All of the wheels are rubber tired.

Each carriage is provided with seven shot trays for handling the projectiles.

The trays consist of a two-pronged hook with a plate riveted inside and with a stop at the rear end, adjustable for locating the different lengths of projectiles with center of gravity nearly under the supporting point.

General remarks.—The necessary tools and implements are furnished with each carriage and are neatly packed in an armament chest marked with the number of the carriage, etc., to the inside of the lid of which is affixed a list of the contents.

There are plates on the carriage indicating the direction of motion of the elevating hand wheels and of the traversing cranks and also instruction plates for filling, etc.

Drain holes are drilled in all pockets, and all axles, bearings, and sliding bearing surfaces are provided with oil holes closed by screw plugs.

The trunnion beds are supplied with compression grease cups. These cups, by means of a spring-actuated cup leather plunger, automatically force the lubricant through the passages and distributing grooves under the bearing surfaces.

ASSEMBLING THE CARRIAGE.

Implements.—The assembling requires machines and implements for mechanical maneuvers usually found at forts; but in addition to falls, blocking, jacks, slings, chains, etc., a derrick capable of lifting 4 tons will be found especially useful.

General remarks.—The size and weight of the carriage permits it to be transported by rail partially assembled.

In assembling the carriage, as in all machinery, no parts should be directly struck with a steel hammer or sledge. Soft metal drifts of copper or lead hammers should be used.

In unloading or handling the parts care should be exercised that the edges or finished surfaces do not become upset or burred.

When two bearing surfaces are brought together, it is especially necessary that both parts should be absolutely clean, free from burrs, and well lubricated.

The following description gives a statement of the order in which the parts should be put together rather than a complete enumeration of the details of the operation.

Base-ring leveling.—Lower or skid the base ring into position over the platform and let it down so that the bolts shall enter the holes centrally, and having the lugs for the traversing chains directly opposite the "front" of the battery. Before reaching the surface of the platform see that either the wedges and shoe plates or, in the later carriages, the screws and thrust plates are in position.

A sensitive machinist's level and an accurate straightedge should be used in leveling.

After freeing the threads of the platform bolts of rust and burrs and oiling the threads and faces of the nuts they may be screwed down nearly to pinch. In screwing down the nuts take up on each a little at a time, so that the base ring will not be unnecessarily strained. The greatest care must be exercised in using the "level" and "straightedge" that the middle of the level is equally distant from the points of the contact of the straightedge with the surface being leveled, and that those points of contact of the straightedge are at an equal distance from either end. *In using the level it should always be reversed and the means of the readings in the two positions considered the true reading.*

Placing the straightedge across the inner top edge of the lower roller path, find the high point, then level around circumferentially, jacking the leveling screws and tightening the foundation bolts until no high points are found and the nuts are screwed moderately tight. After the base ring is properly leveled pour under it a grouting of Portland cement. After this grouting has set firmly the leveling screws should be slightly unscrewed and the foundation bolts set up

solid, after which the base ring should be leveled around circumferentially again to see that the last operations have not displaced it.

Traversing system.—Thoroughly clean the lower roller path on the base ring and the upper roller path on the racer and the pintle surfaces on both. Thoroughly clean and oil the traversing rollers and distance rings and place them in position on the base ring, running them around a few times by hand to see that they work freely.

Move the racer over its proper position and lower by means of jacks, being careful not to cramp or bind the pintle surfaces. Projections from the chassis rails at front and rear will enable jacks to be engaged. When this is down on the rollers, move it around by hand to see that it rotates freely.

The clips and dust guards should now be assembled to keep the traversing rollers clean.

Insert the journal to the traversing worm wheel from the rear, and put on the sprocket and worm wheels. Drive out one of the brass bushings in the transverse worm-shaft bearings and insert the worm shaft through bearings and worm, placing the collars on the shaft at each side of the worm after driving the key. Replace the brass bushing and pin the cranks on the end of the shaft.

Assemble the guide-wheel supports to their brackets and bolt the brackets to the racer. Now fasten one end of the traversing chain to its lug on the base ring by means of the connecting bolt, and lead the chain around under the guide wheel and over the sprocket wheel and under the other guide wheel around to the remaining lug and adjust tension. Be careful to have the chain absolutely without twist or kink and adjust tension so as to give as little backlash at the traversing cranks as is possible without a perceptible increase in the traversing resistance.

Retracting system.—In assembling the retracting gearing the shafts are inserted through the left chassis through their smaller parts and the right chassis, the drums being afterwards attached to the ends of drum shaft. Attach the guide pulleys at the rear end of the chassis and the hooks on each side of the top carriage.

The retraction ropes will be assembled by hooking the loop over the hook and reeving over the pulley at the rear of chassis and back over the drum, drawing the ends under the clamp, and with the clamps set up slightly, put just enough strain on the rope to slip each one taut, after which the clamps should be tightened to prevent further slipping. Carefully note that the ropes are of equal length and do not cause binding of the top carriage on the rails during retraction.

Top carriage.—Thoroughly clean and oil the recoil rollers and their journals and the surfaces of the chassis rail and top carriage, assemble the recoil rollers in position, raise the top carriage in rear of the chassis and slide it forward into position. After it is in position it

should be run forward and backward on the rollers to see that it works entirely free and that all the rolls bear evenly at all points of recoil.

The top carriage will usually be received complete with rods assembled, boxes packed, and cylinders filled with oil, but should be usually dismantled for examination, necessitating reassembling and repacking. See "Care of carriage, general instructions."

Elevating system.—Bolt the front and rear brackets of the elevating side shaft to the chassis. Assemble the pinion shaft and worm gear and the friction clamp in the top carriage and the worm shaft down through its bearings, driving on the lower miter gear in mesh with its mate already assembled in the lug of the top carriage. Pass the side shaft through its bearings and the miter from the rear, assembling the transverse shaft and miters with its front end and placing the hand-wheels on the transverse shaft.

Gun.—Carefully clean and lubricate the trunnions of the gun and the trunnion beds with No. 4½ grease and attach the elevating rack, after which the gun may be moved into position, preferably from the front over the crest of the parapet. Lower into position, being careful not to burr the elevating pinion, which should at this time be free to revolve.

Loading platform.—This platform may now be bolted in place on the chassis and racer and its railing and steps assembled.

Shot hoist.—Assemble the crank shaft with its drum; also pawl bracket and pawl. Mount the crane in its steps, assemble its sheaves, and, reeving the hoisting tackle, pass the end of the rope to the drum and attach.

After assembling.—When the carriage is completely assembled and the cylinders filled with oil, carefully inspect to see that nothing is overlooked, after which the gun may be retracted and allowed to run into battery several times to see that everything works properly.

Special points to be noted.—The following points should be noted, namely:

1. Traverse the carriage and elevate and depress gun to see that they work freely.
2. Examine and clean out all oil holes, noting that they have oil plugs.
3. See that the chassis rails have not been burred.
4. See that the retraction ropes are properly adjusted, follow the grooves on the drum, and are not twisted.
5. See that the dust guards do not bear against the distance rings or base rings.
6. See that the piston rods are parallel to the top of the chassis rails and also to their inside edges.
7. See that the stops to limit the motion in azimuth are properly placed to suit the particular emplacement.

8. Adjust the elevation pointer by the use of a clinometer supported by a rest in the muzzle of the gun, dowel pin it in position and verify the graduations.

9. Orient the gun, add numbers to the degree marks on azimuth circle, adjust azimuth pointer to indicate correct azimuth, and dowel pin it in position. Muzzle at true south is zero degrees in azimuth and numbers are placed around clockwise, to include 359.

10. Attach the telescopic sight bracket to the chassis sight standard and test to see that an accurate telescope placed in it will sight on the same distant point that it will when placed in the trunnion sight bracket or that is covered by the tangent and the bore sights.

Note also that the telescope in the trunnion sight bracket points in the same horizontal plane with the tangent sights when both are set the same elevation and that the elevation read agrees with that given by the clinometer on the gun.

CARE OF THE CARRIAGE.

General instructions.—Carriages should be traversed from time to time throughout their entire movement. They should not be allowed to stand for long periods set at a particular azimuth, as this might cause uneven settlement of the platform. The habitual positions of the gun is in battery, but it should be retracted at intervals and elevated and depressed within the limits of its motion.

It is especially required that all parts of carriages be kept free from rust at all times. If this be allowed to accumulate, its removal from all bearing parts, and especially piston rods, requires particular attention in order that clearances shall not be unduly increased. The use of sandpaper for this purpose is forbidden, emery cloth No. 1 being coarse enough for ordinary rusting, should be used, the rust being softened, if necessary, by kerosene.

The retracting ropes should at all times be kept well oiled with raw linseed oil.

If any leakage occurs from the hydraulic recoil system it should be immediately remedied, calling, if necessary, upon the district armament officer for the services of skilled labor.

The repacking of stuffing boxes may be done, when necessary, by trained enlisted men under the supervision of an officer, but will preferably be done by skilled labor.

Before removing a cylinder head containing a stuffing box, or drawing a piston rod through a stuffing box, the pressure of the packing on the rod should be released by unscrewing the follower several turns.

The vulcanized fiber or copper gaskets between cylinders and their heads should be in good condition, and consequently should be replaced whenever necessary in order to prevent leakage.

Recoil cylinders should be emptied at least every three months and thoroughly cleaned every six months.

Instructions for cleaning recoil cylinders.—For this cleaning a plumber's hand force pump will be supplied to each coast artillery post with about 10 feet of suction hose and 15 feet of discharge tube.

It will be noted that in no case will it be necessary to remove the packing from a stuffing box to clean the cylinders.

In cleaning, the following order of operations may be followed:

(a) Remove oil from cylinders and equalizing pipes.

(b) Retract the gun until the pistons are in the middle of the cylinders, place hard-wood planks 1 inch thick between the front ends of the cylinders and the counter-recoil stops so as to positively retain the top carriage in this position. Care should be taken that both planks are of equal length.

(c) Remove the cylinder heads and both piston-rod nuts, and carefully withdraw the piston rods out of the cylinders. Each part dismantled should be marked to insure its being assembled in its correct place.

(d) Thoroughly clean the cylinders with kerosene oil forced from a hand pump into both ends of each cylinder. The plug in the emptying coupling should be removed and both branches of the equalizing pipe flushed out from their cylinder ends. Then wipe the interior of the cylinders dry with clean cotton waste and clean the piston rods and cylinder heads.

(e) Replace the emptying coupling plug, assemble the piston rods, nuts, and cylinder heads, exercising great care that none of the parts are burned or otherwise damaged. The cylinder heads should be firmly screwed into place, care being taken that the gasket is in good condition and properly placed. Screw the followers tight against the packing in the stuffing boxes.

(f) All parts dismantled should be carefully inspected to ascertain that they have been properly assembled. Retract the top carriage until both planks can be removed, then by means of the retracting gear allow the gun to return slowly into the firing position. After the cylinders have been filled with oil the gun should be retracted and allowed to run into battery several times to insure that all parts are in good working order.

Removing packing from stuffing boxes (using new extractor, to be furnished by the Ordnance Department).—Close the extractor around the piston rod and insert the locking pin. Turn the extractor to the left, with pressure on the packing, until the needles are firmly engaged in the packing. Draw the packing out, turning slowly to the left. In the case of a box with interior thread, and if the ring is tight, it should be unscrewed and not stripped out by the thread, because unless unscrewed it would catch upon and be injured by the thread.

Extractor bars are provided to be used for starting the packing from its seat and by inserting the toes of the bars in the rack teeth and prying over the edge of the box, being careful not to injure the thread.

To pack or repack a stuffing box.—Examine the old packing and discard all unfit for use. If any of the old packing is used it should be put in after the new. See that the stuffing boxes are well cleaned and oiled.

Put on the piston rod one ring of 1-inch Garlock's "waterproof hydraulic" packing and force it well to the bottom of the stuffing box by a wooden stick and mallet. Treat each layer of packing in a similar manner, being careful to break joints until five rings of new packing have been inserted, or an equal amount of new and old when any of the latter is used. Place the gland on the follower, enter them together in the box, and screw up the follower.

No more force should be used on the spanner wrench than that of two men, and generally that of one man is sufficient. The addition of the pipe to the end of the spanner wrench should not be permitted.

When the box is properly filled and the follower tightened, there should not be more than 1 inch of space between the flange of the follower in the piece in which the follower is screwed. The follower should be tightened from time to time. If the follower is screwed into the stuffing box too tightly, an unnecessary amount of friction will be produced on the friction rod. When the follower is screwed in until the flange strikes the box another ring of packing should be inserted.

It is to be expected that a slight amount of oil will soak through and drip from boxes of carriages when not in use. Also when tightening the followers a slight amount of oil will squeeze out of the saturated packing. This oil should be caught in the drip pan and not allowed to render the carriage unsightly.

Filling recoil cylinders.—To fill the cylinders with oil, remove the two plugs, one in each cylinder. Pour clean neutral oil of specific gravity about 0.85 (such as the "hydroline" now issued to the service) into the hole of one cylinder until it flows out of the hole of the other. Allow any air that may be present to escape, then pour in more oil until the system is filled to the level of the filling hole.

Service condition (lubrication, etc.).—When the carriage is to be kept in readiness for service and is in daily or frequent use, all bearing parts must be kept thoroughly cleaned and lubricated. Special attention should be given to the lubrication of trunnion beds, rollers, pintle surfaces, shaft bearings, and sliding surfaces, and the elevating, traversing, and retracting mechanisms, including the teeth of all gears.

The above parts should be lubricated at frequent intervals, whether the carriage is maneuvered or not. When carriages are in use for daily drills, a thorough lubrication twice each week should be sufficient for all but the most severely used parts.

Recoil cylinders.—Experience has shown that the recoil cylinders should not be emptied, as in that case the interior walls soon become dry and rusty.

Oil holes.—These, where provided, must be cleaned out frequently to keep them free from sand and grit, and will habitually be kept closed by the screw plugs provided, except when in the act of oiling.

Before oiling at any oil hole wipe off carefully any dirt or grit near the opening that might be carried down into the bearing by the oil.

Compression grease cups.—When compression grease cups are provided, similar precautions against dirt or grit must be observed. In filling these cups do not fill the cup completely, but fill only to the bottom of the bevel at the top of the cup; if too full, the leather packing will become inverted and will not act effectively. In putting on the cap see that the leather-packed follower enters the cup without being caught, cut, or bent by the edge of the cup or otherwise. Screw the cap down on the cup, using a wrench, if necessary, to secure sufficient power, until the spring rod projects about 0.25 inch above the top of the cap. Later, when the spring has recovered and has moved the follower forward, forcing the grease through the tube into the bearings, which will be indicated by the spring rod being pulled into the cap until its nut touches or nearly touches the cap, it will again be necessary to screw up the cap on the cup until the spring is again compressed. When the cap is screwed nearly home and the spring rod does not project, it is an indication that the cup should be refilled.

List of articles packed in armament chest for 9-inch rifle, model of 1888, mounted on barbette carriage, model of 1892.

1 bar screw driver, breech-plate screws.	1 gunner's drill.
3 bar screw drivers, breech mechanism screws.	1 gunner's pouch.
1 obturator-spindle nut wrench.	1 pair gunner's sleeves.
1 obturator nut clamp-screw wrench.	1 gunner's lanyard.
1 pin punch.	1 metal scraper.
1 tit wrench for obturator spindle.	4 balls twine, assorted.
1 pressure-plug wrench.	2 pounds copper wire, No. 12.
1 ring for lifting breech plate.	2 pounds copper wire, No. 16.
2 bronze drifts.	1 quire emery cloth, No. 00.
1 gunner's punch.	3 wagon sponges.
	1 file, flat, dead smooth, 8-inch.

For further information regarding paints, oils, cleaning materials, and methods of using same, see Ordnance Department pamphlet, Form No. 1869. Annual allowances will also be found in this pamphlet.

List of articles packed in armament chest for 8-inch rifle, model of 1888, mounted on barbette carriage, model of 1892.—Continued.

1 file, round, second cut, 8-inch.
 1 file, half-round, smooth, 8-inch.
 1 file, three-cornered, 8-inch.
 1 copper hammer.
 1 boilermaker's hammer.
 1 hand mallet.
 1 cutting pliers (pair 7-inch).
 1 monkey wrench, 12-inch.
 1 monkey wrench, 15-inch.
 10 pounds cotton waste.
 1 long-handled mallet.
 1 box containing firing mechanism.

In firing mechanism box :

1 cleaning reamer for primer seat.
 3 cleaning brushes for primer seat.
 1 extension handle.
 To be used on bruised breechblocks ; no other files to be used thereon :
 3 files, pillar, No. 6, 6-inch.
 3 files, three-cornered, No. 4, 6-inch.
 3 files, half-round, smooth, 8-inch.
 3 files, round, smooth, 8-inch.

List of implements packed in implement box for 8-inch barbette carriage, model of 1892.

2 screw-eye extractors.
 1 screw driver for dust guard.
 1 screw driver for recoil roller journal.
 1 screw driver, commercial.
 1 spanner wrench for stuffing box and cylinder head.
 1 box wrench for friction clamp.
 2 wrenches for piston rods.
 1 double wrench for .375 and .5 inch nuts.
 1 double wrench for .625 and .875 inch nuts.

1 double wrench for .75 and 1.5 inch nuts.
 1 single wrench for 1-inch nuts.
 1 single wrench for 1.125-inch nuts.
 1 single wrench for 1.25-inch nuts.
 1 single wrench for 2.75-inch nuts.
 1 crane block and rope.
 1 oiler, locomotive (1 quart).
 1 oiler (half pint).

List of implements furnished with 8-inch rifle, model of 1888.

1 rammer and staff.
 1 rammer and staff, short.
 1 sponge and staff, bore.
 1 sponge and staff, chamber.
 1 sponge and rammer prop.
 1 breech cover.
 1 combined tompon and muzzle cover.
 1 sponge cover, bore.

1 sponge cover, chamber.
 1 slush brush with handle to connect with special sponge staff.
 1 steel scraper and socket to fit special sponge staff.
 1 special sponge staff for slush brush and steel scraper.

List of implements supplied for 8-inch rifle, model of 1888, and barbette carriage, model of 1892.

2 paint pots (gallon).
 1 sieve for paints and oils.
 2 brushes, wall, 4-inch (expendable).
 3 sash tools, No. 6 (expendable).

3 brushes, paint, 6/0 (expendable).
 2 dusters, painter's, No. 2 (expendable).

GASKETS AND PACKING.

1 set of gaskets for carriage ; 10 rings, Garlock's waterproof hydraulic packing, 1 inch square and 3.25 inches inside diameter.

Weights of parts of 8-inch barbette carriage, model of 1892.

No.	Name of parts.	Material.	Weight.
			<i>Pounds.</i>
1	Basing	Cast iron	19,850
1	Racer and chassis	Cast iron	19,000
1	Platform	Iron and steel	1,000
1	Top carriage	Cast steel	6,620
2	Piston rods	Forged steel	340
2	Piston heads	Forged steel	90
16	Recoil rollers	Forged steel	864
16	Journals for recoil rollers	Forged steel	112
2	Nuts for piston rods	Forged steel	34
2	Nuts for piston rods	Forged steel	28
2	Stuffing boxes	Bronze	280
2	Rear cylinder heads	Cast steel	252
4	Throttling bars	Forged steel	120
1	Journal for worm wheel	do do	84
1	Crank shaft	do do	85
2	Cranks with handles	do do	40
2	Guide wheels	do do	28
2	Bolts, chain connection	do do	16
1	Worm	do do	72
1	Worm wheel	do do	122
1	Sprocket wheel	do do	61
2	Supports for guide wheel	do do	88
2	Distance rings	do do	580
10	Braces	do do	130
2	Brackets	do do	162
20	Conical rollers	do do	2,300
4	Guide hooks	do do	562
1	Chain	do do	112
1	Drum shaft	do do	82
1	Intermediate shaft	do do	22
1	Crank shaft	do do	105
1	Collar	do do	4
1	Spur pinion	do do	14
1	Intermediate gear	do do	53
2	Shaft bushings	do do	14
2	Rope pulleys	do do	54
2	Drums	do do	88
2	Shaft brackets	do do	92
2	Loops	do do	4
1	Shaft bushing	do do	15
1	Drum gear	do do	140
2	Wire ropes	do do	11
1	Bracket	do do	142
2	Hooks	do do	70
2	Pulley brackets	do do	104
2	Pulley-bracket studs	do do	26
1	Worm	do do	36
1	Worm wheel	do do	49
1	Pinion	do do	13
1	Rack	do do	50
1	Shaft for worm	do do	22
1	Shaft for worm wheel	do do	20
1	Shaft for miters	do do	75
1	Shaft for handwheel	do do	73
2	Collars	do do	7
4	Miters	do do	32
2	Handwheels	do do	140
1	Friction clamp	do do	23
6	Bushings	do do	50
1	Front bearing	do do	30
1	Rear bearing	do do	40
1	Crane mast	do do	103
2	Crane-mast brackets	do do	127
4	Crane sheaves	do do	10
2	Crane blocks	do do	11
1	Crane-sheave bracket	do do	5
1	Crane wire rope	do do	13
1	Crane drum	do do	75
1	Crane pawl and bracket	do do	8
2	Cranks, with handles	do do	40
2	Racer steps, with brackets	do do	45
1	Sight standard	do do	63
2	Grease cups	do do	6
	Bolts, nuts, etc	do do	1,117
	Total weight of carriage		56,355
3	Ammunition trucks	Iron and steel	675
7	Pairs shot tongs	Iron and steel	130
	Grand total		57,160

List of parts of the carriage.

Name of parts.	Location.	Material.	Num-ber.	Length.	Diameter.	Kind.	Remarks.
Azimuth circle.....	On base ring (lower roller path).....	Brass.....	a 6	Inches.	Inches.	.....	Brass screws. 2 screws, 2 dowels.
Azimuth pointer.....	Bolted to right rear-guide hook (racer clip).....	Brass.....	.....	.....	.....	.....	.....
Base ring (lower roller path).....	On foundation.....	Cast iron.....	1	.....	128	.....	4 bolts.
Cap squares.....	Bolted to top carriage.....	Steel.....	2	.....	.....	.....	.....
Chassis and racer (upper roller path).....	On traverse rollers.....	Cast iron.....	1	.....	.....	.....	.....
.....	Right loading-platform support.....	Steel.....	1	.....	.....	.....	.....
.....	Right loading-platform support.....	Steel.....	1	.....	.....	.....	.....
.....	In rear cylinder head.....	Wrought iron.....	2	.....	.....	.....	4 bolts.
.....	In hoisting tackle.....	Bronze.....	1	.....	.....	.....	.....
.....	Crane block.....	Wrought iron.....	1	.....	.....	.....	With pin and nut.
.....	Crane block.....	Wrought iron.....	1	.....	.....	.....	.....
.....	Crane block.....	Wrought iron.....	1	.....	.....	.....	With nut.
.....	Crane block.....	Steel.....	1	.....	.....	.....	.....
.....	Through bearings in chassis.....	Wrought iron.....	1	.....	.....	.....	2 collars, 4 set screws, and 1 key.
.....	On crane-crank shaft.....	Forged steel.....	1	.....	.....	.....	With retaining catch and screw.
.....	On crane-crank handle.....	Wrought iron.....	2	.....	.....	.....	With brass ferrules.
.....	On crane-crank.....	Wrought iron.....	2	.....	.....	.....	With nut.
.....	On crane-crank shaft.....	Forged steel.....	1	.....	.....	.....	Set screw.
.....	On pawl ratchet bracket.....	Cast iron.....	1	.....	.....	.....	Pin, nut, and 2 bolts.
.....	On pawl.....	Wrought iron.....	1	.....	.....	.....	Pin, chain, and eyebolt.
.....	In crane brackets.....	Wrought iron.....	1	.....	.....	.....	.....
.....	Bolted to left chassis.....	Wrought iron.....	1	.....	.....	.....	5 bolts and 1 screw.
.....	Bolted to left chassis.....	Cast iron.....	1	.....	.....	.....	Washer, bolt, and key.
.....	On crane mast.....	Wrought iron.....	1	.....	.....	.....	Bolt and nut.
.....	Through crane bracket and sheave.....	Wrought iron.....	1	.....	.....	.....	Nut.
.....	For crane.....	Wire.....	1	.....	.....	.....	With hook.
.....	For crane mast.....	Bronze.....	3	.....	.....	.....	.....
.....	On crane mast.....	Wrought iron.....	1	.....	.....	.....	.....
.....	Through hood and sheave.....	Steel.....	1	.....	.....	.....	With nut.
.....	Screwed into rear of cylinder.....	Cast steel.....	2	.....	.....	.....	With gaskets (fiber).
.....	Rests on traverse rollers.....	Wrought iron.....	b 1	.....	.....	.....	.....
.....	Between distance rings.....	Cast iron.....	10	.....	.....	.....	.....
.....	Through distance ring and separator.....	Wrought iron.....	10	.....	.....	.....	With nuts.
.....	Bolted to racer (upper roller path).....	Wrought iron.....	1	.....	.....	.....	36 bolts.
.....	On elevating worm-gear shaft.....	Bronze.....	1	.....	10.805	.....	.....
.....	On elevating through shaft.....	Bronze.....	2	.....	.....	.....	Nut and pin.
.....	On elevating side shaft.....	Bronze.....	2	c 1	.....	15 teeth	.....
.....	On elevating worm shaft.....	Bronze.....	1	c 1	.....	15 teeth	.....
.....	On elevating through shaft.....	Bronze.....	1	c 1	.....	15 teeth	.....
.....	Bolted to gun.....	Forged steel.....	1	c 1.25	d 30.347	.....	.....
.....	On elevating worm-wheel shaft.....	Forged steel.....	1	c 1.25	6.768	15 teeth	.....

List of parts of the carriage—Continued.

Name of parts.	Location.	Material.	Num-ber.	Length.	Diameter.	Kind.	Remarks.
Stuffing box bushing.....	Screwed into front end of cylinder.	Bronze.....	2	<i>Inches.</i>	<i>Inches.</i>		Fiber gaskets.
Stuffing box gland.....	In stuffing box bushing next to packing.	Bronze.....	2				
Stuffing box follower.....	Screwed into stuffing box bushing.	Bronze.....	2				
Top carriage.....	On chassis.....	Cast steel.....	1				
Top carriage bushings.....	On top carriage.....	Bronze.....	4				28 bolts with lead washers.
Throttling bars.....	Bolted to inside of cylinder.	Steel.....	8				12 bolts.
Thrust plates.....	On foundation.....	Steel.....	4				
Traversing bracket.....	Bolted to racer front.....	Cast iron.....	1				Nut, pin, washer, and cotter.
Traversing chain.....	On base ring.....	Wrought iron.....	1				
Traversing chain bolt.....	End of chain.....	Forged steel.....	2	340	1.5		
Traversing worm wheel.....	On traversing worm wheel journal.....	Cast iron.....	1	11.25			
Traversing crank.....	On crank shaft.....	Wrought iron.....	2				With nuts.
Traversing crank handle.....	On crank shaft.....	Wood.....	2				
Traversing crank handle sleeve.....	On crank handle.....	Wrought iron.....	2				2 collars, key, 4 set screws.
Traversing crank shaft.....	Through front end of chassis.....	Forged steel.....	1				8 screws.
Traversing direction plate.....	Sides of chassis.....	Bronze.....	2				
Traversing guide wheels.....	On guide wheel supports.....	Wrought iron.....	2				
Traversing rollers.....	On base ring.....	Forged steel.....	20	13.48	7.0652		2 bolts.
Traversing stop.....	On left rear guide hook.....	Steel.....	1				
Traversing stop pins.....	On base ring (lower roller path).....	Wrought iron.....	2				
Traversing support for guide wheels.....	Through traversing bracket.....	Steel.....	2				
Traversing worm.....	On crank shaft.....	Steel.....	1	8	7.732		2 nuts, 2 journals, 2 oil plugs.
Traversing worm wheel.....	On worm wheel journal.....	Bronze.....	1	1.75	19.496		Left-hand thread.
Trunnion bed bushing (in halves).....	On top carriage.....	Forged steel.....	1			33 teeth.....	Oil plug.
Washer for foundation bolts.....	Through bearing front of racer.....	Bronze.....	1				With nut and split pin.
Cylinder plug.....	On top carriage.....	Cast iron.....	2				16 brass screws.
Grease cup.....	On flange of base ring.....	Bronze.....	16				
Grease cup pipes.....	For fitting pipe connection cavities.....	Bronze.....	4				
Grease cup pipe elbows.....	Top carriage.....	Brass.....	2				
Retraction bracket.....	Top carriage.....	Malleable iron.....	4				
Retraction crank-shaft bushing.....	Top carriage.....	Cast iron.....	2				
Retraction crank shaft and pinion.....	Chassis.....	Bronze.....	1				
Retraction drums.....	Through chassis.....	Forged steel.....	1				With oil plug.
Retraction drum clamp.....	Retraction drum shaft.....	Forged steel.....	1				With connection and pins.
Retraction drum gear.....	Retraction drum.....	Forged steel.....	2				
Retraction drum shaft.....	Drum shaft.....	Forged steel.....	1				
Retraction drum shaft bracket.....	Through chassis.....	Forged steel.....	1				
Retraction hook (left).....	Chassis.....	Cast iron.....	1				
Retraction hook (right).....	On top carriage.....	Cast steel.....	1				
Retraction intermediate gear.....	On top carriage.....	Cast steel.....	1				
Retraction intermediate shaft.....	On retraction intermediate shaft.....	Cast steel.....	1				
Retraction rope.....	Through chassis and retraction bracket.....	Forged steel.....	1				
Retraction rope pulley.....	Retraction rope drum.....	Cast steel.....	2	180	.5		With collar.
	Retraction rope pulley bracket.....	Cast iron.....	2		10.8		

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